# FIG. 1
PRIOR ART

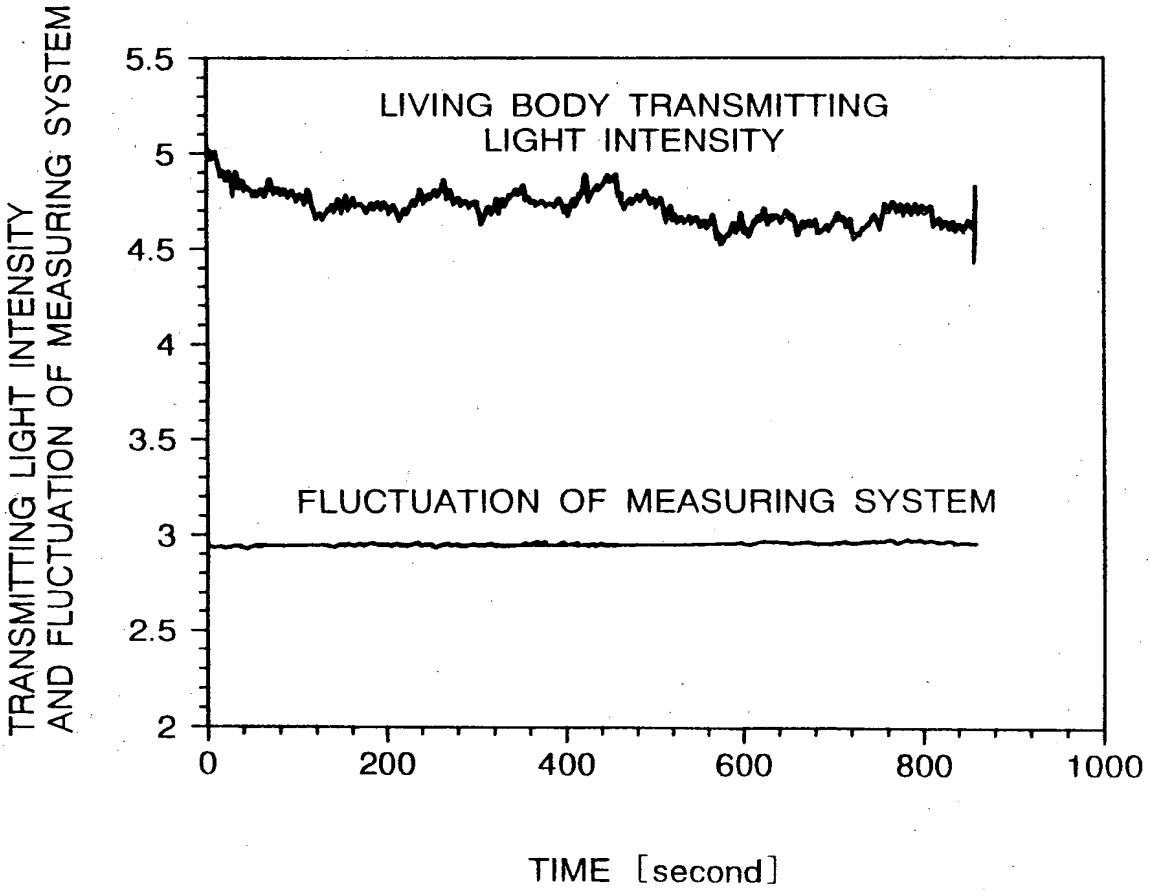


FIG. 2

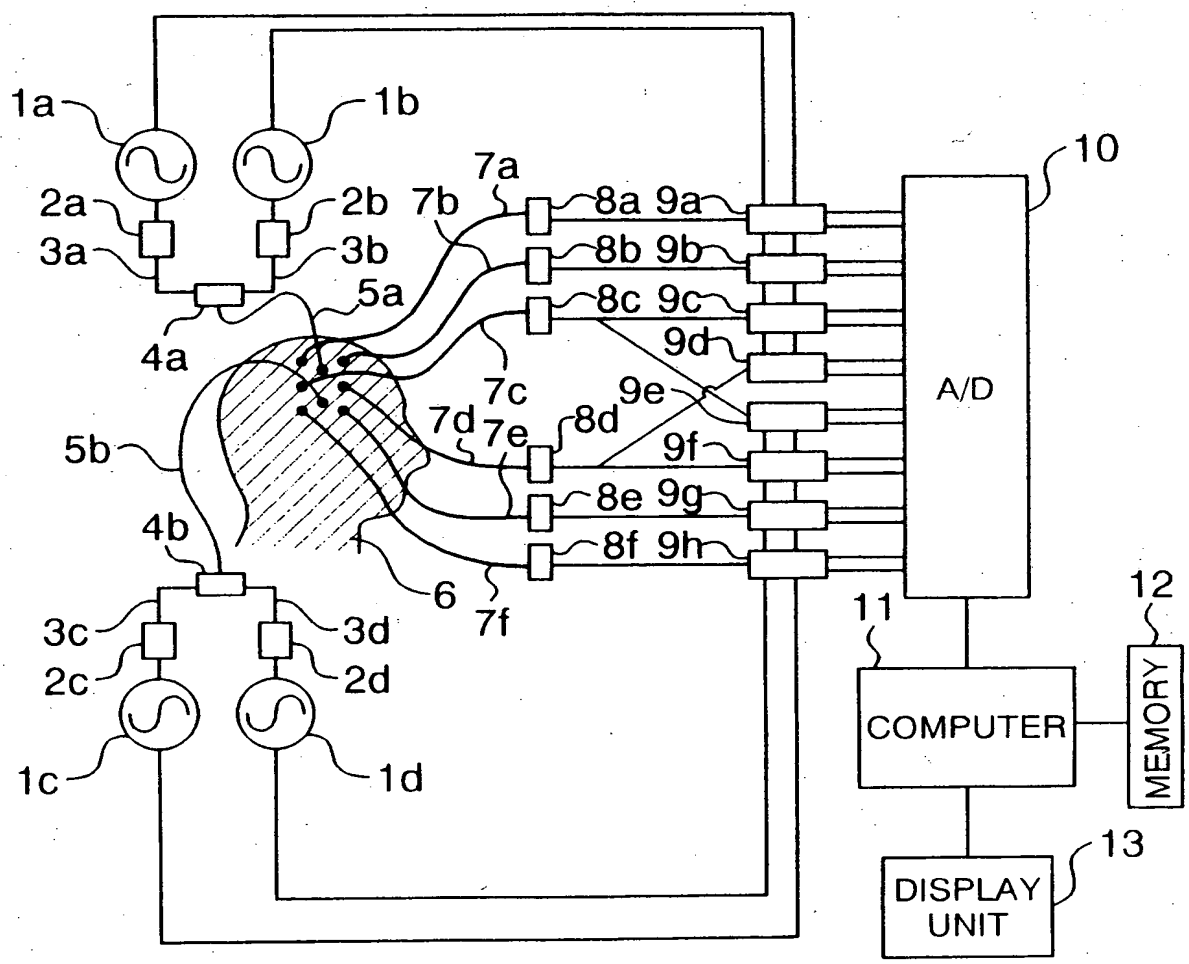

1a
1b
2a
2b
3a
3b
4a
5a
5b
4b
3c
3d
2c
2d
1c
1d
7a
7b
7c
7d
7e
7f
6
8a 9a
8b 9b
8c 9c
9d
9e
8d
9f
8e 9g
8f 9h
10
A/D
11
12
COMPUTER
MEMORY
13
DISPLAY UNIT

FIG. 3

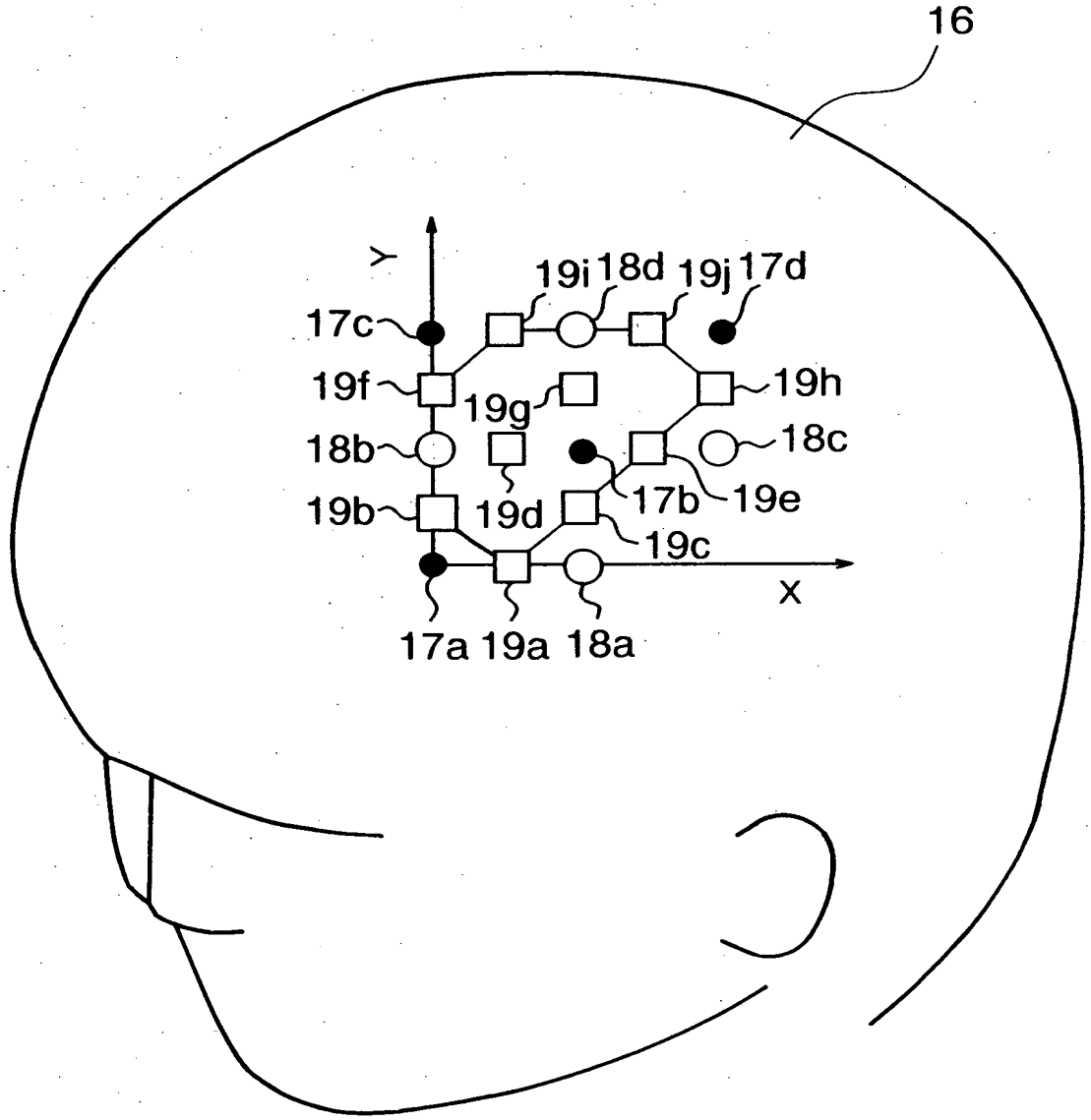

16
Y
19i
18d
19j
17d
17c
19f
19g
19h
18b
18c
19b
19d
17b
19e
19c
X
17a
19a
18a

FIG. 4

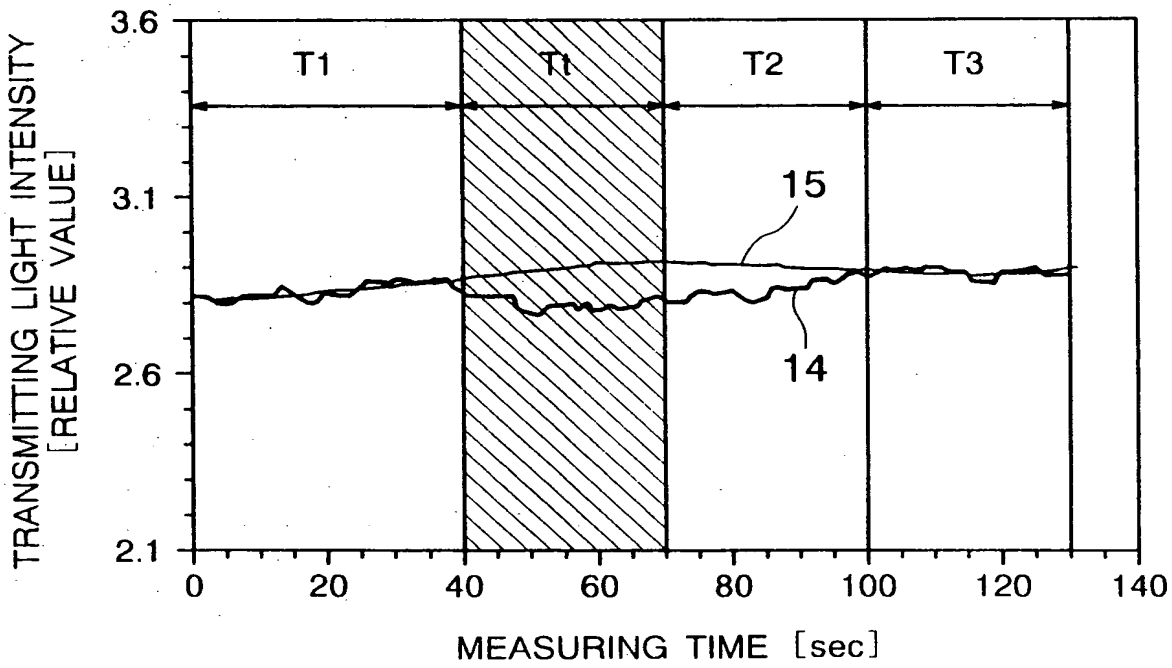

TRANSMITTING LIGHT INTENSITY
[RELATIVE VALUE]
3.6
3.1
2.6
2.1
T1
Tt
T2
T3
15
14
0
20
40
60
80
100
120
140
MEASURING TIME [sec]

FIG. 5

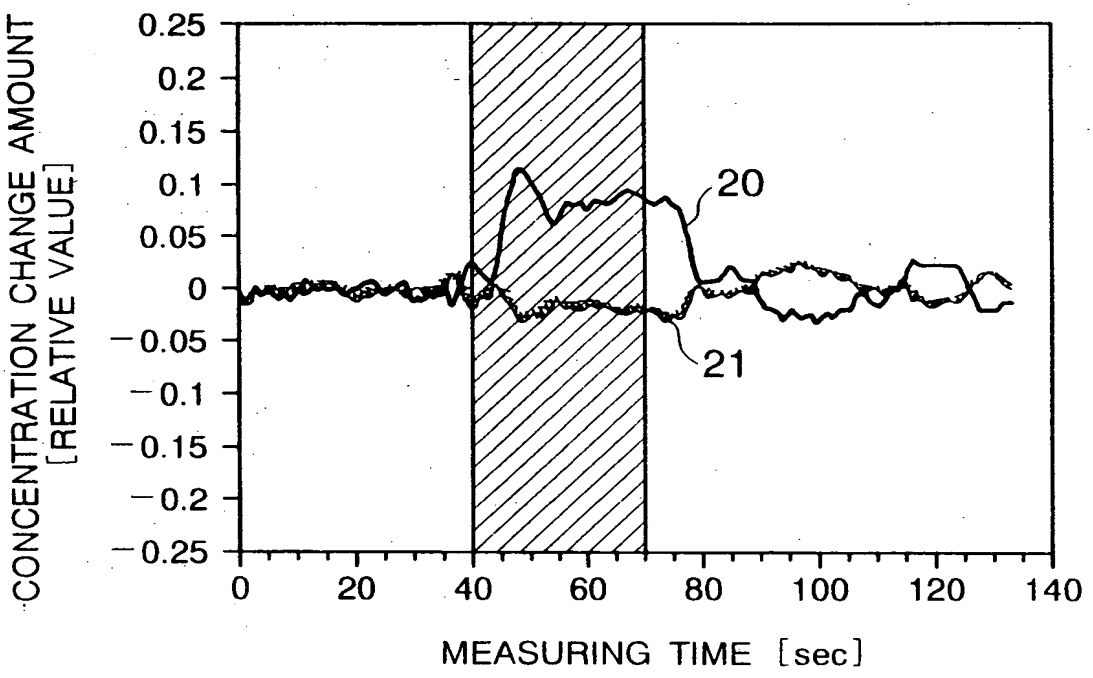

CONCENTRATION CHANGE AMOUNT
[RELATIVE VALUE]
0.25
0.2
0.15
0.1
0.05
0
−0.05
−0.1
−0.15
−0.2
−0.25
0
20
40
60
80
100
120
140
MEASURING TIME [sec]
20
21

FIG. 6

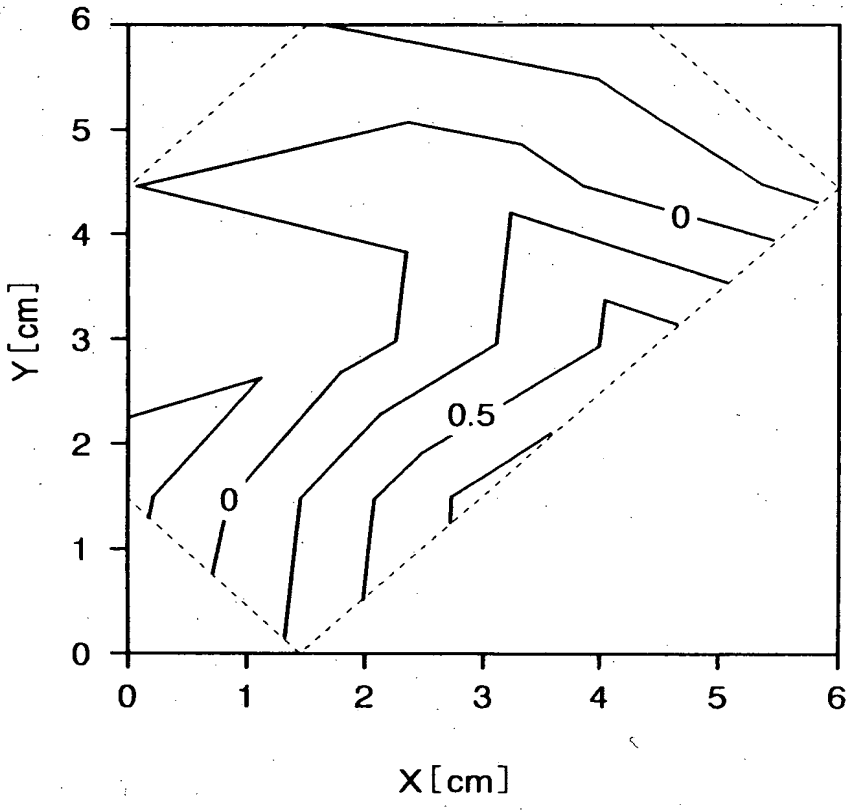


FIG. 7

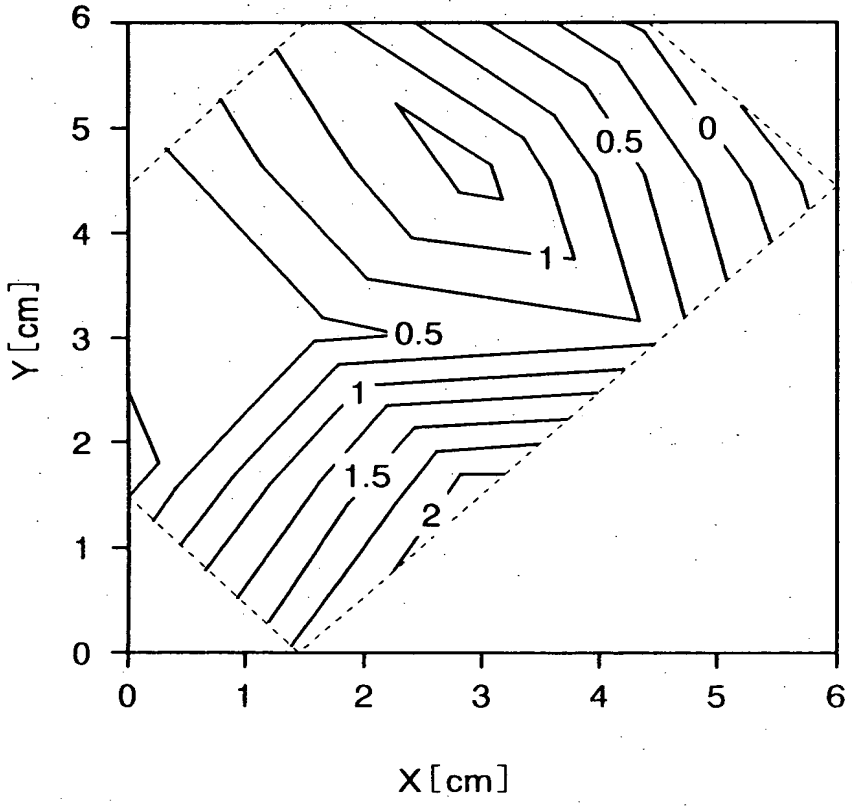


FIG. 8

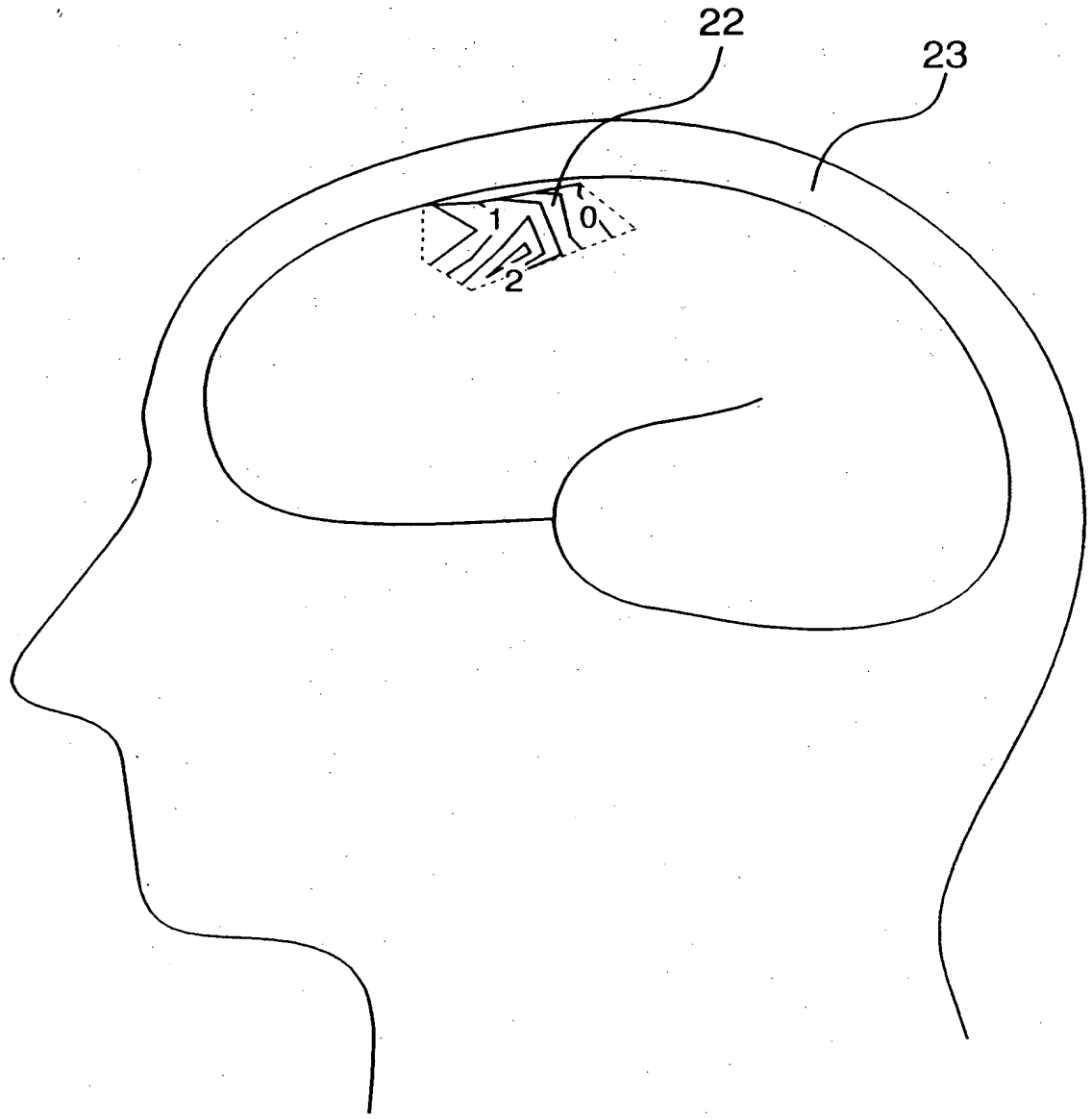


FIG. 9

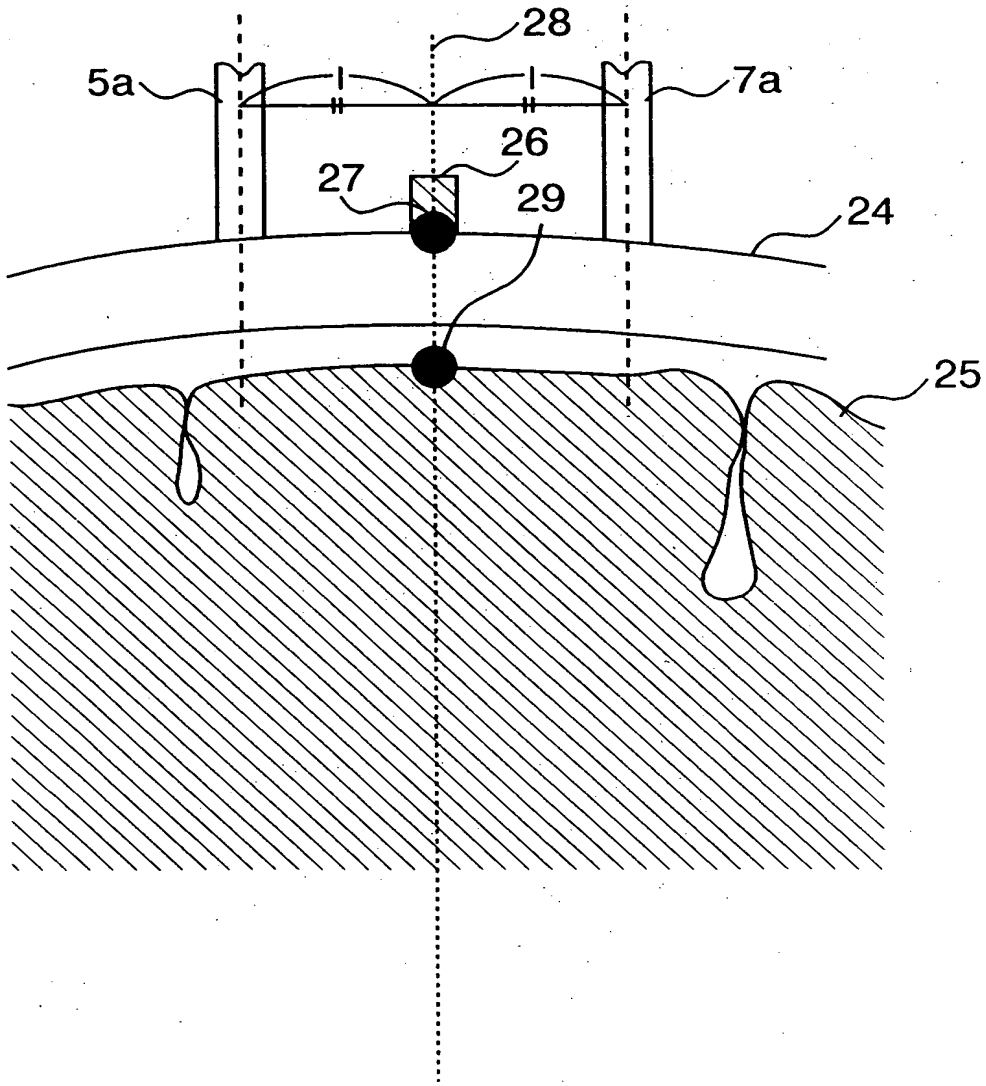


FIG. 10

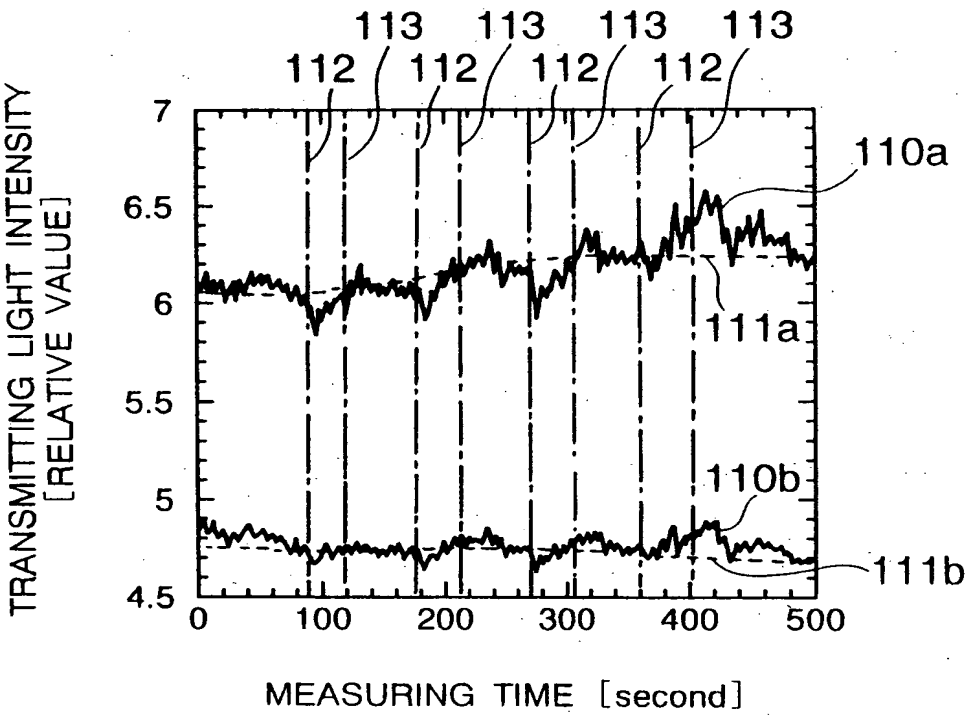

113
113
113
113
112
112
112
112
110a
111a
110b
111b
TRANSMITTING LIGHT INTENSITY
[RELATIVE VALUE]
7
6.5
6
5.5
5
4.5
0
100
200
300
400
500
MEASURING TIME [second]

FIG. 11A

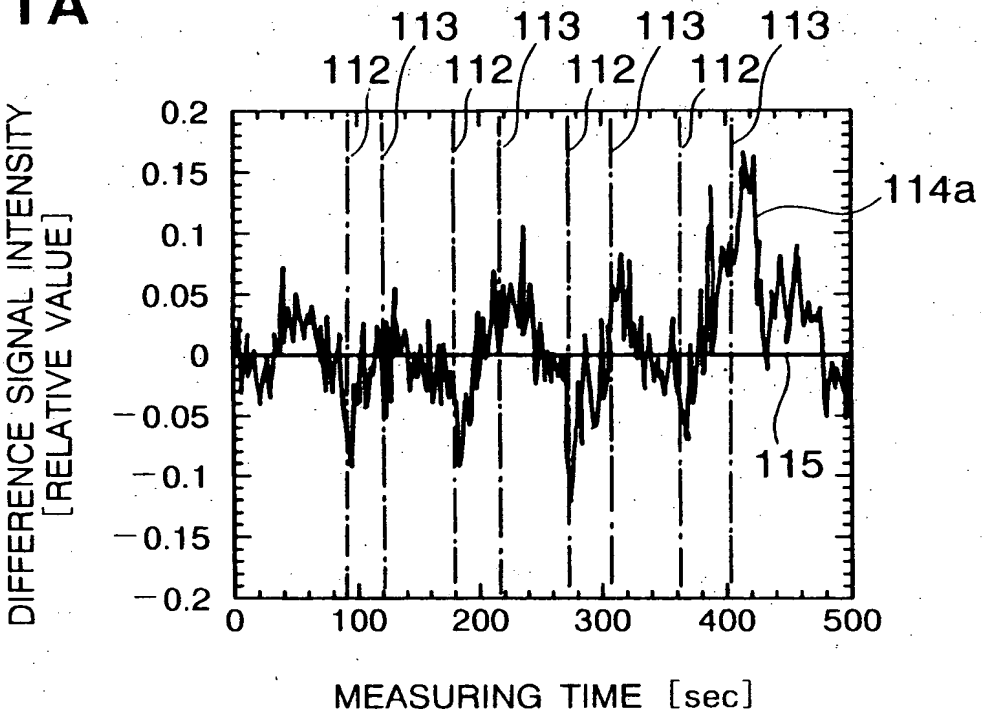



FIG. 11B

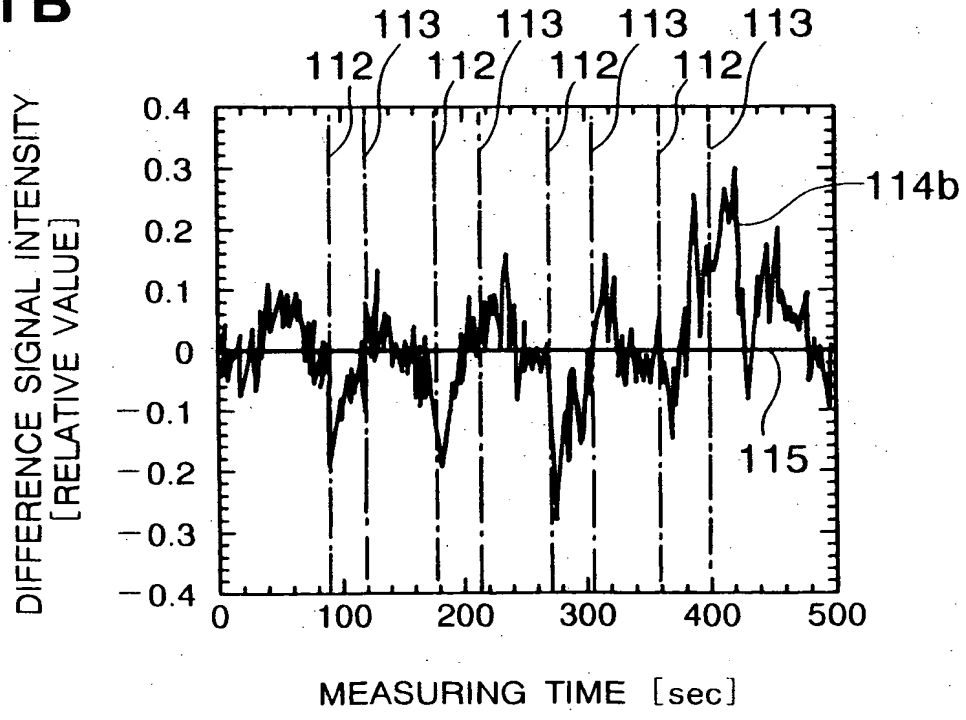


FIG. 12A

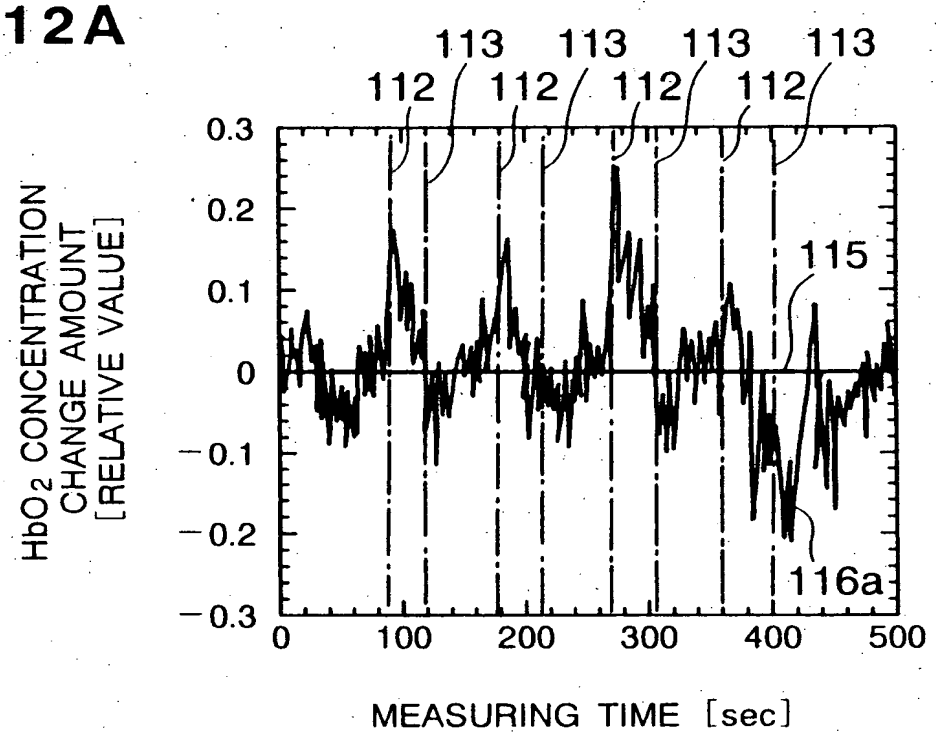



FIG. 12B

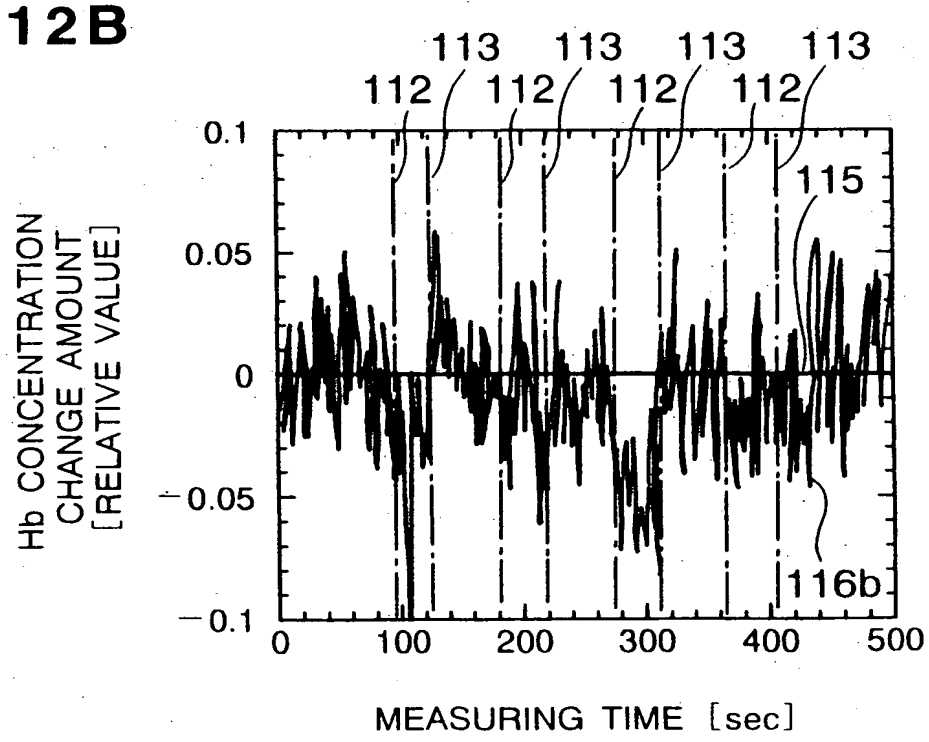


FIG. 13

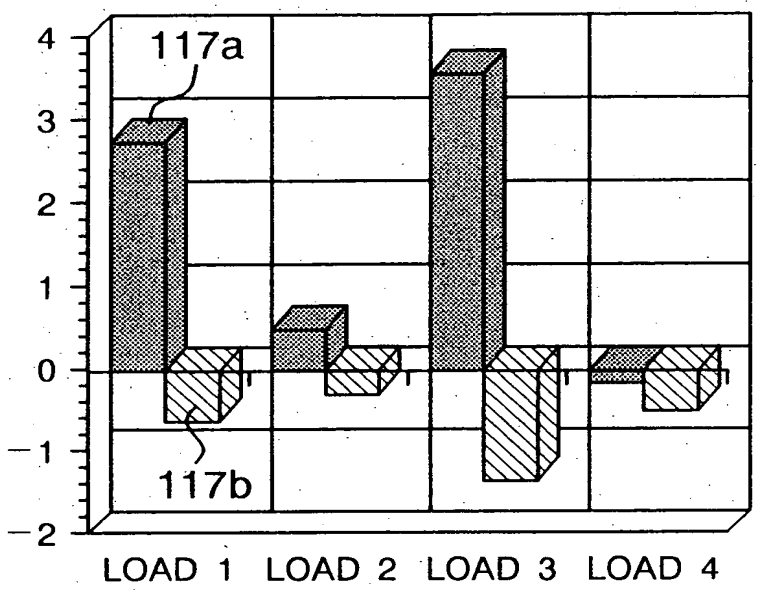

4
3
2
1
0
−1
−2
117a
117b
LOAD 1
LOAD 2
LOAD 3
LOAD 4

FIG. 14

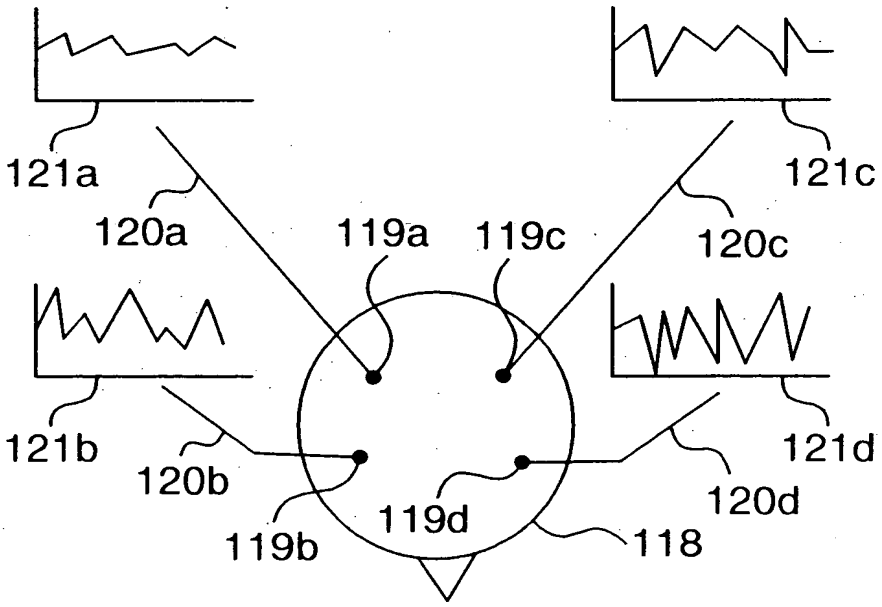

121a
120a
119a
119c
120c
121c
121b
120b
119b
119d
118
120d
121d

FIG. 15

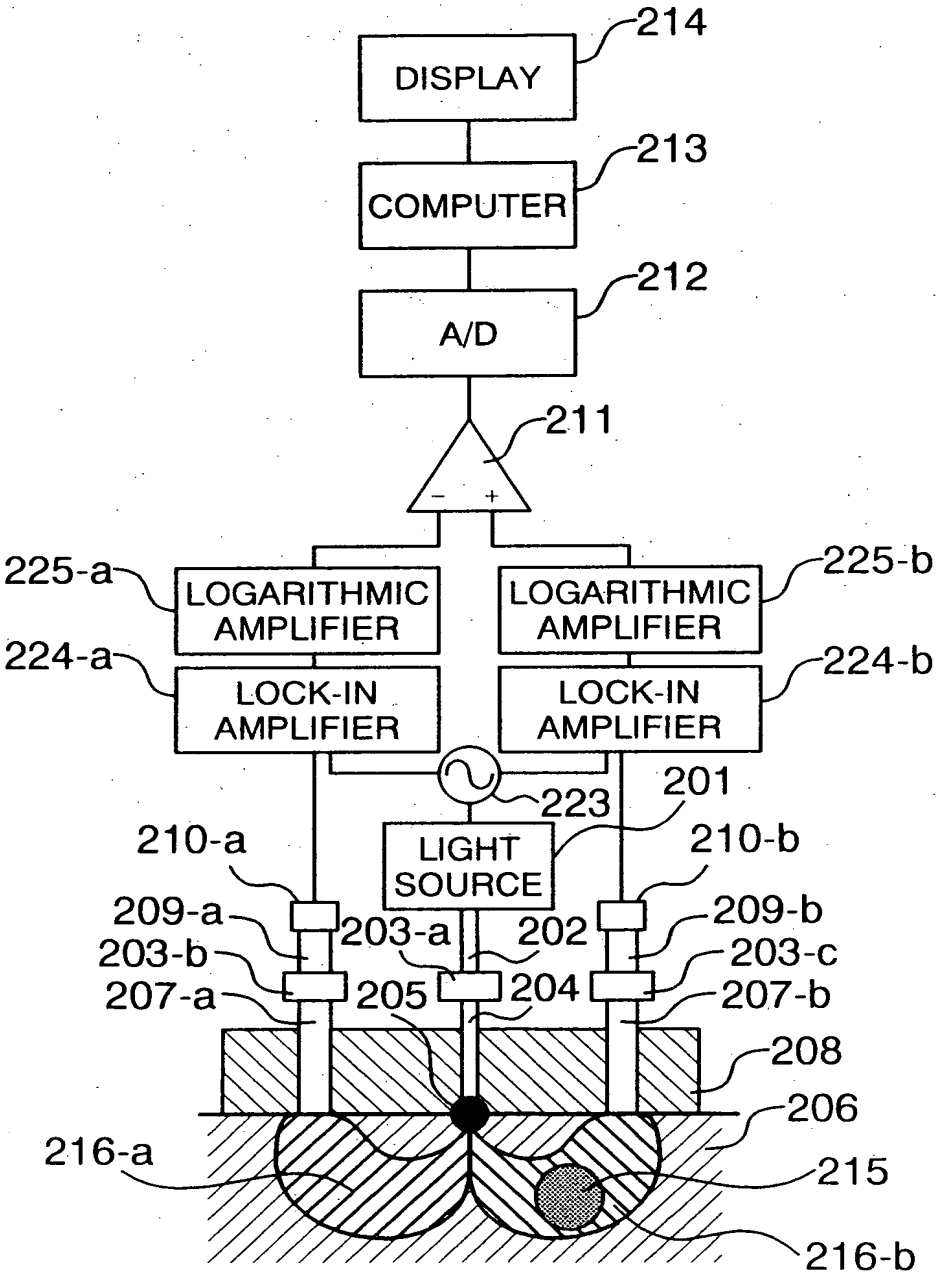

214
DISPLAY
213
COMPUTER
212
A/D
211
225-a
LOGARITHMIC AMPLIFIER
225-b
LOGARITHMIC AMPLIFIER
224-a
LOCK-IN AMPLIFIER
224-b
LOCK-IN AMPLIFIER
223
201
LIGHT SOURCE
210-a
210-b
209-a
209-b
203-a
202
203-b
203-c
207-a
205
204
207-b
208
206
216-a
215
216-b

FIG. 16

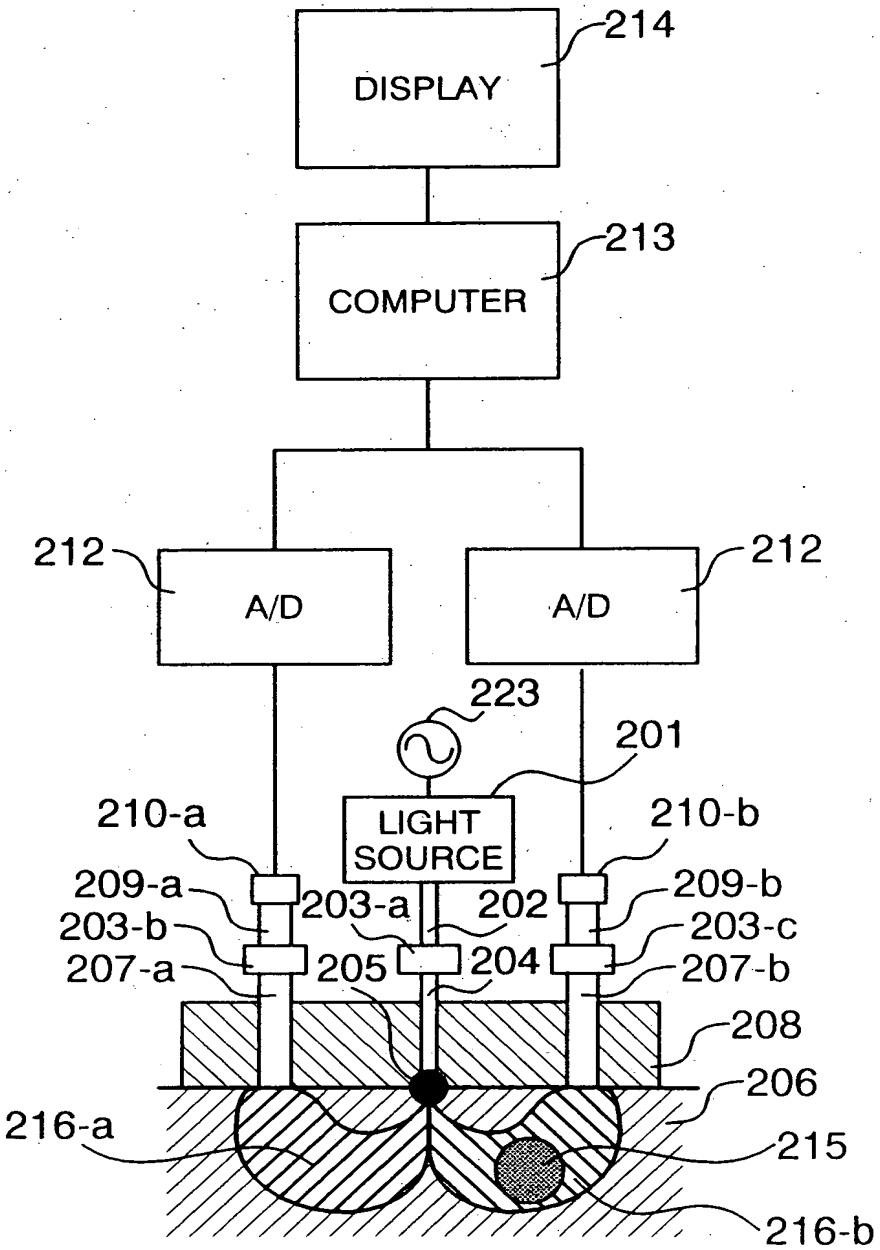

DISPLAY
214
COMPUTER
213
212
A/D
A/D
212
223
201
LIGHT SOURCE
210-a
210-b
209-a
209-b
203-a
202
203-b
203-c
207-a
205
204
207-b
208
206
216-a
215
216-b

FIG. 17A

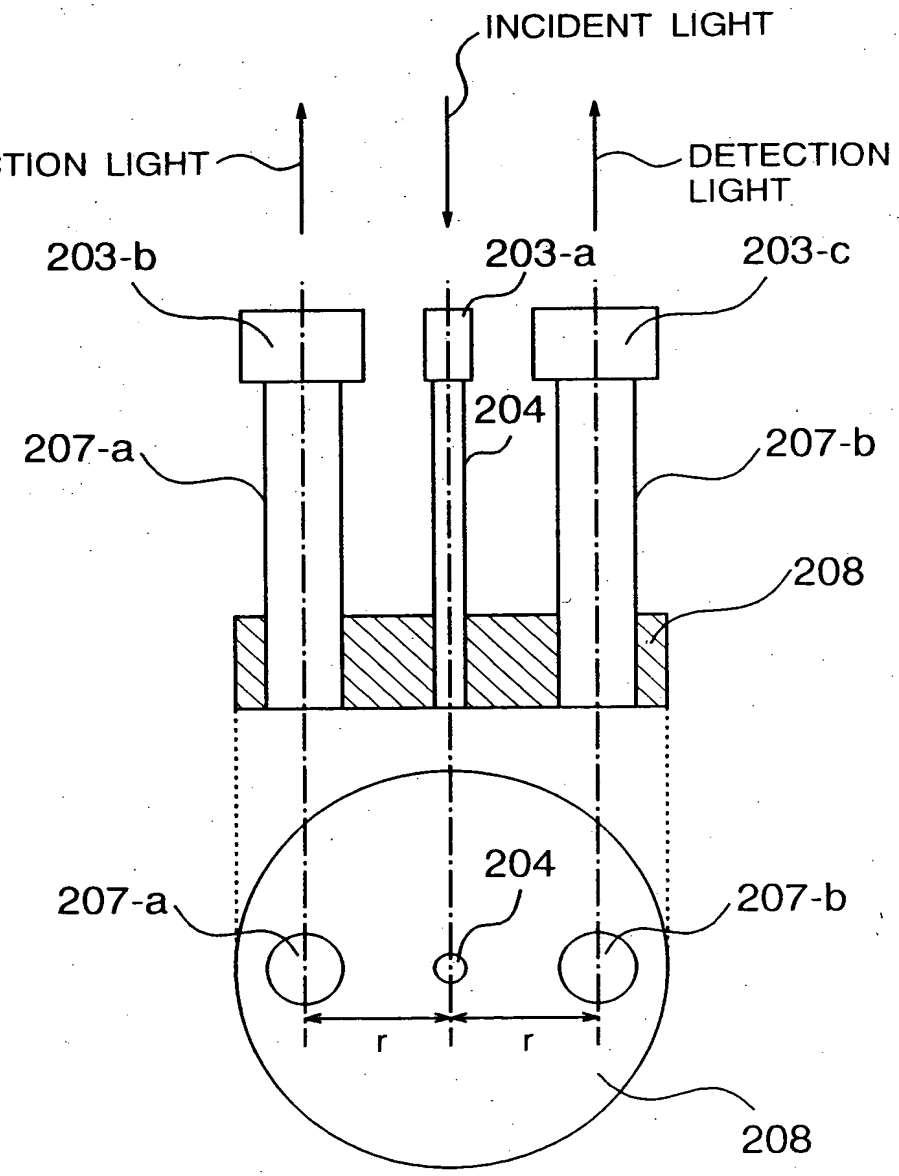



FIG. 17B

FIG. 18

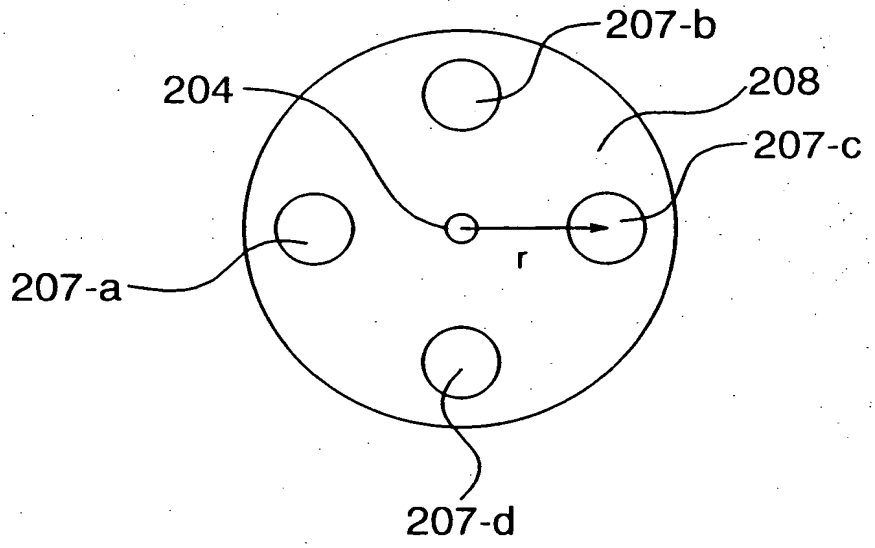

207-b
204
208
207-c
r
207-a
207-d

FIG. 19

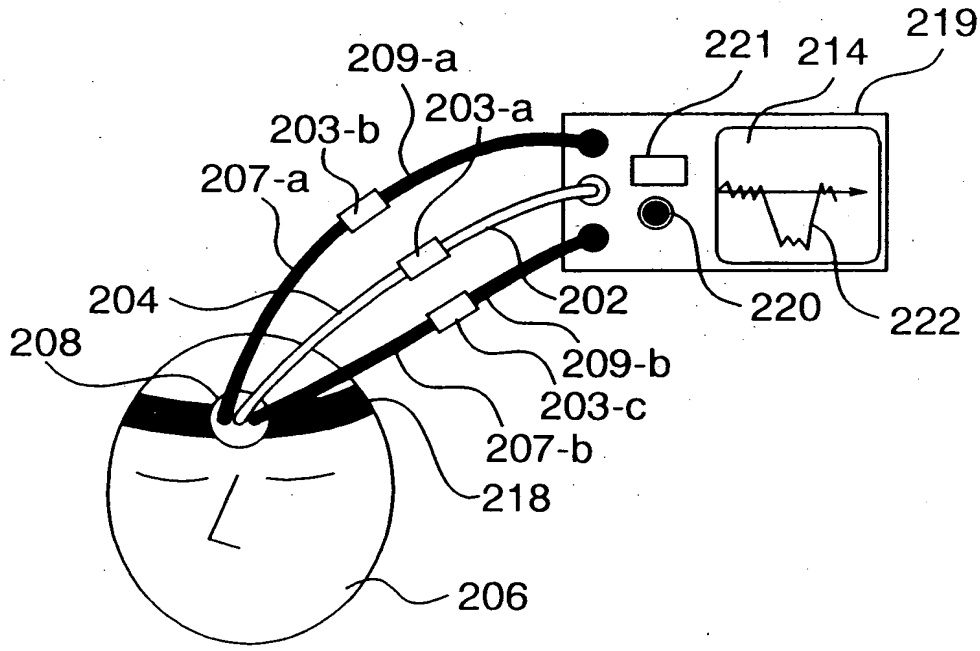

219
221
214
209-a
203-a
203-b
207-a
204
202
220
222
208
209-b
203-c
207-b
218
206

FIG. 20

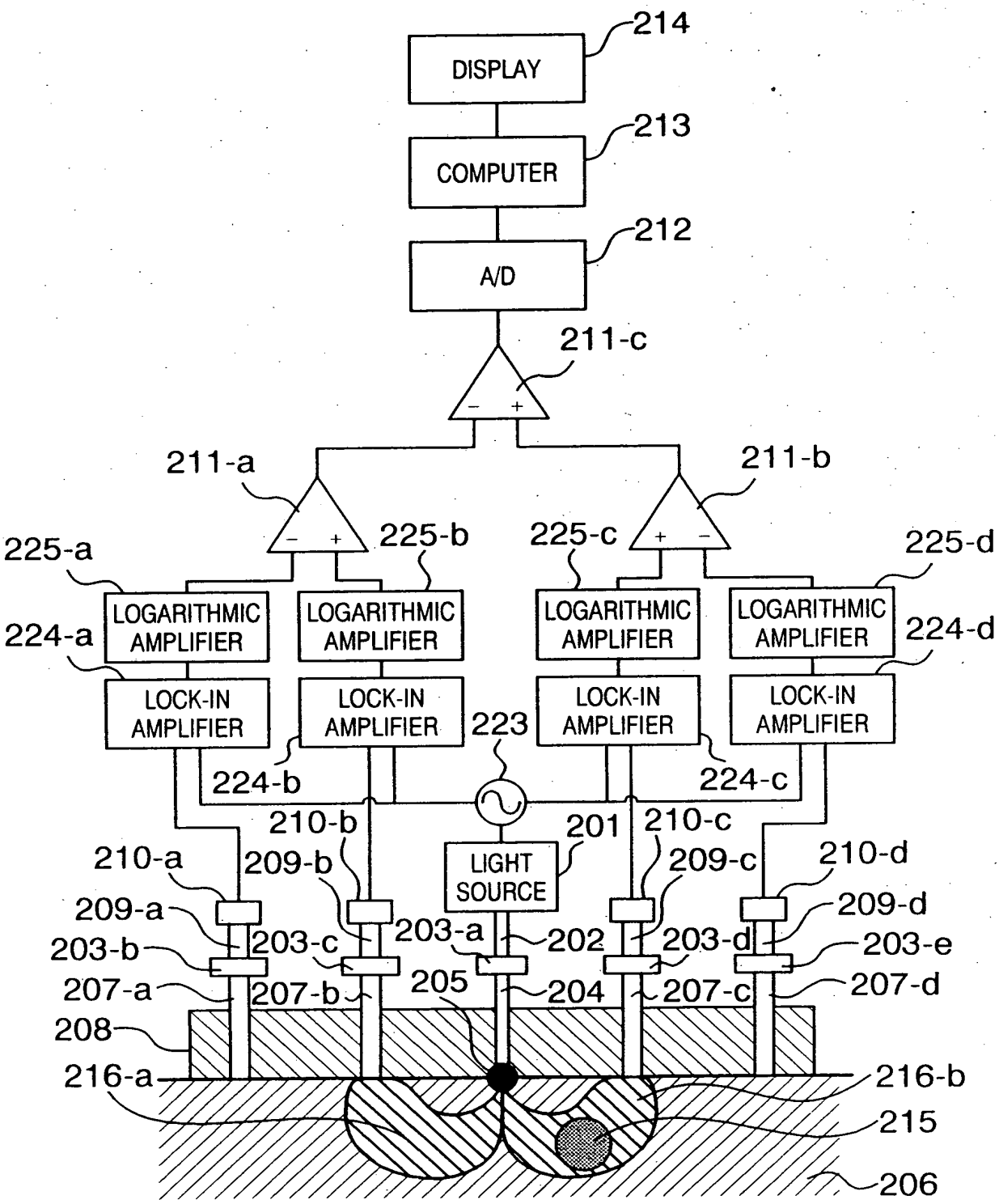

214
DISPLAY
213
COMPUTER
212
A/D
211-c
211-a
211-b
225-a
225-b
225-c
225-d
224-a
224-d
LOGARITHMIC AMPLIFIER
LOCK-IN AMPLIFIER
223
224-b
224-c
210-a
210-b
210-c
210-d
201
LIGHT SOURCE
209-a
209-b
209-c
209-d
203-a
203-b
203-c
203-d
203-e
202
205
204
207-a
207-b
207-c
207-d
208
216-a
216-b
215
206

FIG. 21

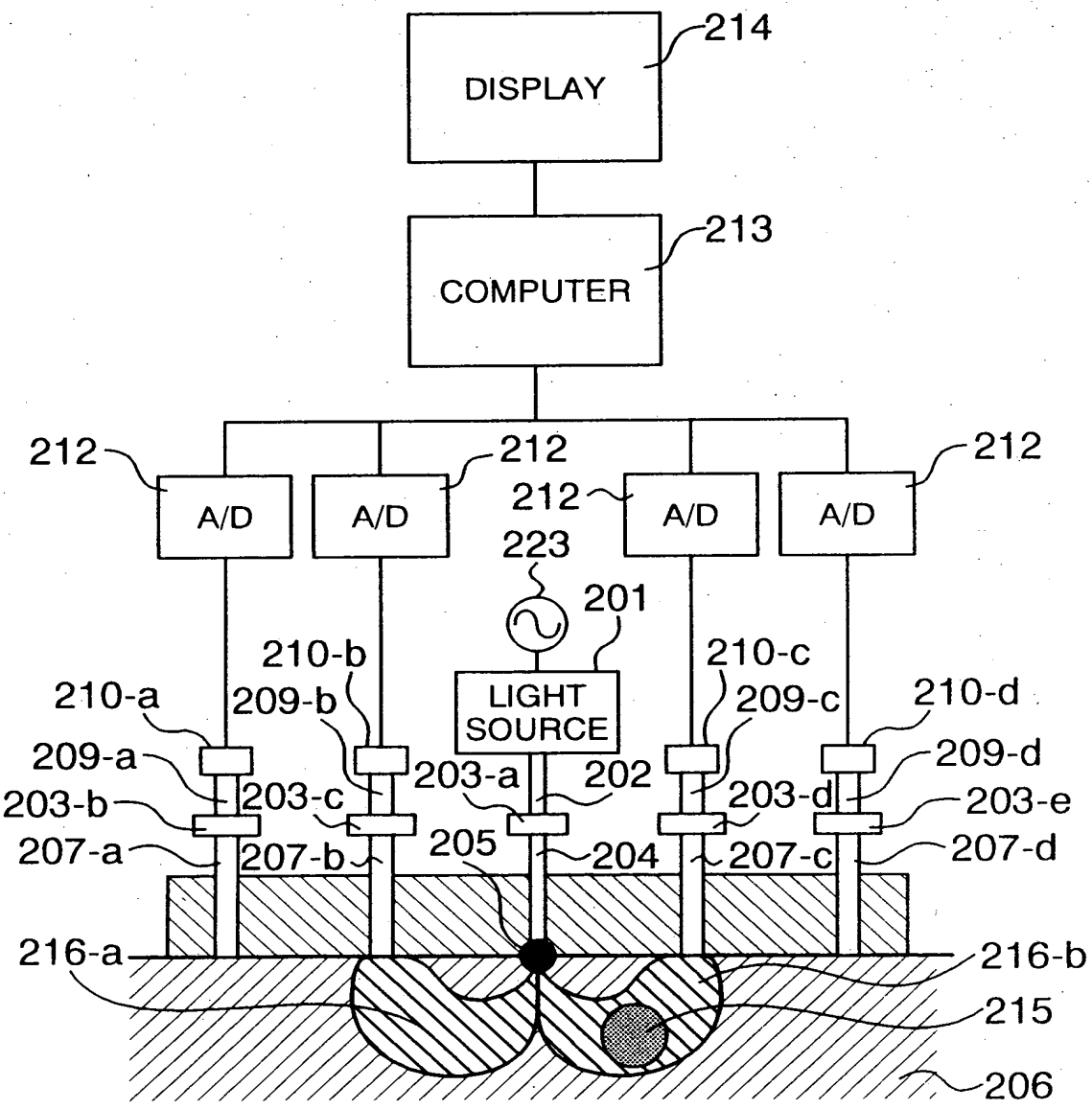

DISPLAY
214
COMPUTER
213
212
A/D
A/D
212
212
A/D
A/D
212
223
201
LIGHT SOURCE
210-a
209-a
203-b
207-a
210-b
209-b
203-c
207-b
203-a
202
205
204
210-c
209-c
203-d
207-c
210-d
209-d
203-e
207-d
216-a
216-b
215
206

FIG. 22

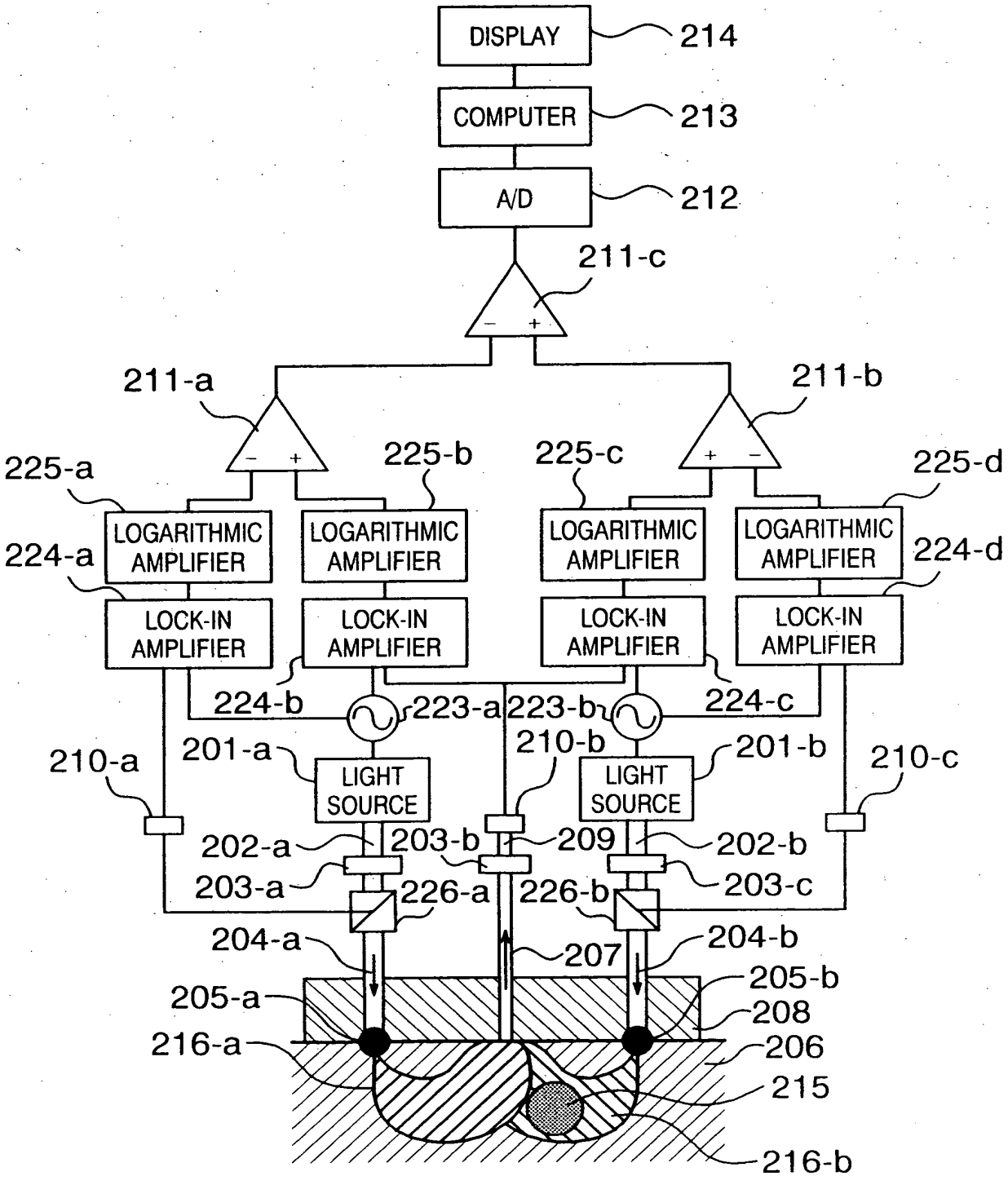
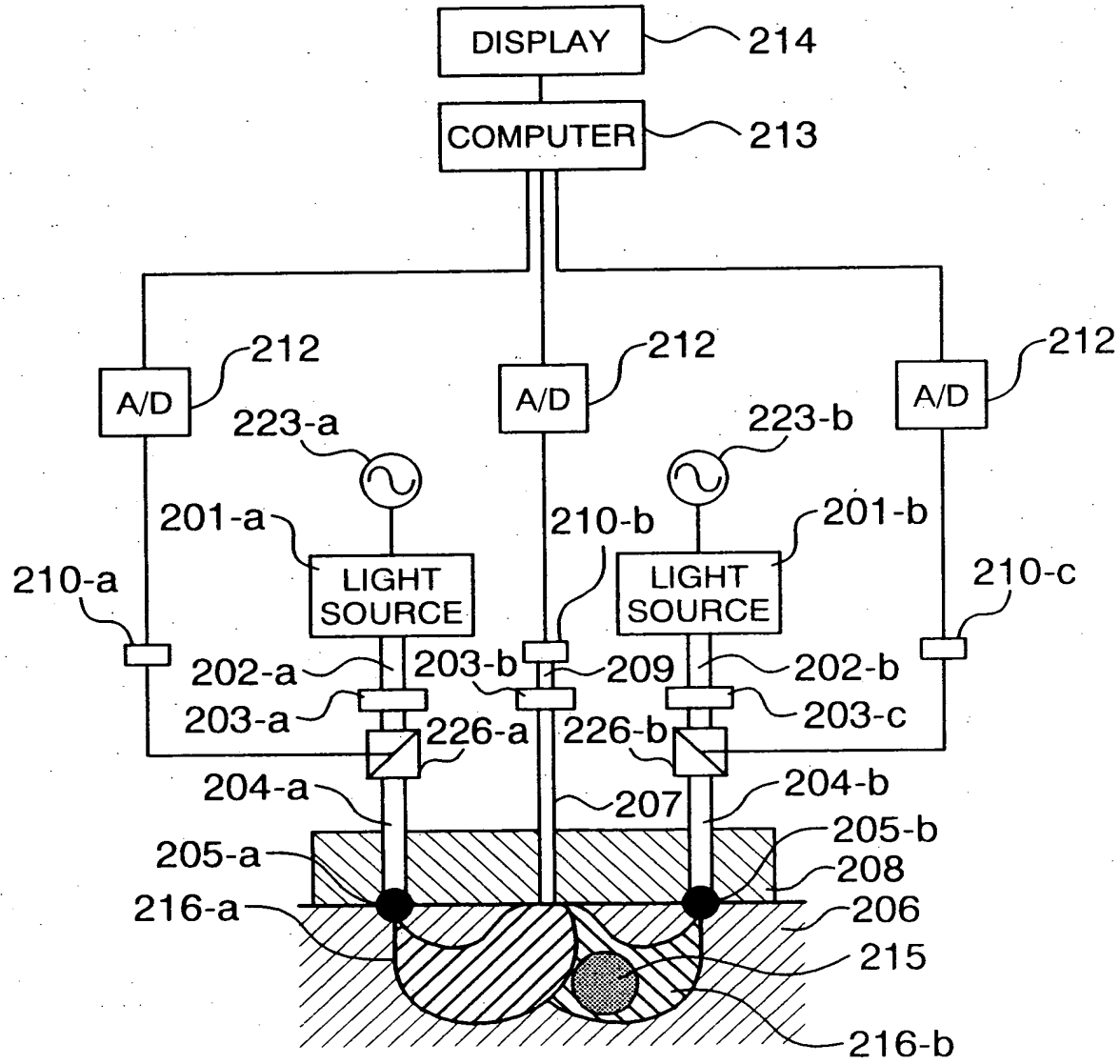

DISPLAY
214
COMPUTER
213
A/D
212
211-c
211-a
211-b
225-a
225-b
225-c
225-d
LOGARITHMIC AMPLIFIER
LOGARITHMIC AMPLIFIER
LOGARITHMIC AMPLIFIER
LOGARITHMIC AMPLIFIER
224-a
224-d
LOCK-IN AMPLIFIER
LOCK-IN AMPLIFIER
LOCK-IN AMPLIFIER
LOCK-IN AMPLIFIER
224-b
223-a
223-b
224-c
210-a
201-a
210-b
201-b
210-c
LIGHT SOURCE
LIGHT SOURCE
202-a
203-b
209
202-b
203-a
226-a
226-b
203-c
204-a
207
204-b
205-b
205-a
208
216-a
206
215
216-b

FIG. 23


DISPLAY
214
COMPUTER
213
A/D
212
A/D
212
A/D
212
223-a
223-b
201-a
210-b
201-b
LIGHT SOURCE
LIGHT SOURCE
210-a
210-c
202-a
203-b
209
202-b
203-a
226-a
226-b
203-c
204-a
207
204-b
205-b
205-a
208
216-a
206
215
216-b